

Teacher's Guide

Participating in AWQA Day

Table of Contents			
Activity	Topic	Audience	Page
Program Introduction and Overview	Registering for AWQA Day and Planning a Field Testing Activity	Teacher	1
Classroom Pre-Lab	Introduction to Water Quality Testing	Teacher Key	2
		Student	3
Teacher Field Lab Worksheets	Dissolved Oxygen	Teacher Information and Answer Key	4-5
	pH		6-7
	Temperature		8-9
	Turbidity		10-11
Student Field Lab Worksheets and Background Information	Dissolved Oxygen	Student	12-13
	pH		14-15
	Temperature		16-17
	Turbidity		18-19
Post-Lab Classroom	Reviewing Results	Teacher Key	20
Post-Lab Worksheet	Water Quality Extension	Teacher Key	21
		Student	22
Appendix	AWQA Day Checklist	Teacher	23-25
	Introduction to Water Quality Testing	Teacher	26-27
	Optional Classroom Discussion Activity	Teacher Key	28-29
		Student	30-31

Introduction

This guide will help you prepare for and deliver the AWQA Day program, supporting you in providing a high quality, hands-on educational experience for your grade 8 and 9 students. Collecting the data will give them firsthand experience with concepts of water quality testing, and their results will become a part of the bigger provincial picture of water quality.

Upon completion of this lab your students should be able to:

- ✍ Identify the four AWQA Day water quality test parameters
- ✍ Explain why water quality is important
- ✍ Describe potential threats to water quality of surface waterbodies in Alberta
- ✍ Suggest possible personal action they can take to care for water health
- ✍ Discuss what it means to be a watershed steward

Be sure to enter your school name in the organization field when you register and indicate your affiliation as "Junior High (Grade 8 or 9)", to be qualified for school prizes.

AWQA Day Checklist

- ✍ REGISTER your class by April 30 2007
 - ✍ ORDER an AWQA Day group test kit
 - ✍ CHOOSE a water body to sample and a sampling site(s)
 - ✍ SELECT a day between May 15 and June 30 2007 for your class to sample a local water body
 - ✍ ARRANGE transportation, meals and other possible elements of your sampling day event
 - ✍ REGISTER your sampling site(s) on your AWQA Day website profile(s)
 - ✍ PREPARE your resources and background materials
 - ✍ TEST your chosen waterbody and enjoy the day
 - ✍ POST your results on your AWQA Day profile(s) for each site sampled by July 15 2007
 - ✍ REVIEW your results in-class
- (For detailed information see appendix)*

Things to consider when choosing sampling sites:

- ? Water quality will vary within a water body depending on depth, distance from shore, etc. Since near-shore samples are not necessarily representative of the entire body of water, you may want to consider collecting your sample from a bridge, at the end of a dock, or from a boat.
- ? The best source of comparative data comes from tests on different parts of the same waterbody. (For example, above and below a point where run-off water runs into a river.)
- ? **Do not compromise safety in order to collect a representative sample!**
- ? It is important that you adequately describe your site so that you or others can find it again for future sampling. Your description of your monitoring location should consist of very specific directions and specific site characteristics, including surrounding landmarks.
- ? A camera, to record visual images of the site and conditions of the

Teacher's Guide Classroom Pre-Lab

Intro to Water Quality Testing Worksheet— Teacher Key



Water Testing Safety Tips

Your safety comes first!

- ? Sample from safe, accessible locations such as secure banks, beaches, or public parks
- ? Always bring along one or more partners
- ? Do not wade in swift currents or high water
- ? Wear weather-appropriate clothing and PFDs when you are near or in the water.
- ? Wear safety glasses and rubber gloves when testing water samples
- ? If you are not comfortable sampling for any reason - please DON'T

Ask your teacher for more information on water testing safety, or visit www.awqa.ca.

Question 1: List three reasons why water quality testing is important.

Note: Answers may vary; you may consider having a discussion.

- 1) Highlight water quality changes over time. _____
- 2) Discover the impact of activities around the water. _____
- 3) Help us learn about how our water systems work. _____

Question 2: What range of pH usually supports the largest number of organisms?

From 6 to 9.

Question 3: Where can I find more information on Water Testing Safety?

Taken directly from the take-home text, answers may include “from your teacher”, or “by visiting www.awqa.ca”. Students may have done some research and found websites or government contacts that deal specifically with water and boating safety, or they may suggest other sources such as their local library.

Fill in the blanks in the following statements using either “rise” or “fall”:

When photosynthesis increases, dissolved oxygen levels rise.

With increased aeration (mixing), dissolved oxygen levels rise.

When temperature increases, dissolved oxygen levels fall.

When turbidity increases, dissolved oxygen levels fall and temperature levels rise.

Student Classroom Pre-Lab

Introduction to Water Quality Testing—Worksheet



Water Testing Safety Tips

Your safety comes first!

- ? Sample from safe, accessible locations such as secure banks, beaches, or public parks
- ? Always bring along one or more partners
- ? Do not wade in swift currents or high water
- ? Wear weather-appropriate clothing and PFDs when you are near or in the water.
- ? Wear safety glasses and rubber gloves when testing water samples
- ? If you are not comfortable sampling for any reason - please DON'T

Ask your teacher for more information on water testing safety or visit www.awqa.ca.

Question 1: List three reasons why water quality testing is important.

- 1) _____
- 2) _____
- 3) _____

Question 2: What range of pH usually supports the largest number of organisms?

From _____ to _____.

Question 3: Where can I find more information on Water Testing Safety?

Fill-in the blanks in the following statements using either “rise” or “fall”:

When photosynthesis increases, dissolved oxygen levels _____.

With increased aeration (mixing), dissolved oxygen levels _____.

When temperature increases, dissolved oxygen levels _____.

When turbidity increases, dissolved oxygen levels _____ and temperature levels _____.

Teacher's Guide Field Lab Test #1: Dissolved Oxygen

Teacher Information and Answer Key

Preparation

Read through the lab before you begin.

Materials

- ✍ small test tube (2ml)
- ✍ two dissolved oxygen reagent tablets
- ✍ rubber gloves and goggles
- ✍ colour coding chart

Ensure all sampling equipment is clean and free of contaminants (dust, skin oil, etc.) and dry. If you are sampling more than one site, rinse repeatedly at the next site before testing.

Do not touch the inside or opening of any sampling containers or tubes to help avoid contamination.

Testing Procedure

1. Rinse the tube three times in the water body
2. For flowing-water sites (rivers, streams, etc.):
 - ✍ aim the open end of your sampling tube upstream
 - ✍ place at mid-depth and allow the tube to overflow for about 30 seconds under water

For still-water sites (lakes, ponds, etc.):

- ✍ submerge the sampling tube (open-side up) into the water, between 25 and 50 cm below the water surface

Try to avoid excessive turbulence or bubbling.

3. Make sure your tube is full to the top
4. Drop in the two reagent tablets (some water should spill over)
5. Screw the cap on tightly (more water will overflow)
6. Invert repeatedly (**do not shake**) until tablets have dissolved completely (approximately 4 minutes)

It will take approximately 5 minutes for the colour change to occur.

Special Considerations

Dissolved oxygen readings will be affected by excess shaking of the tube, turbulence in the water when initially collecting, air bubbles or air space in the tube, intense sunlight, pressure changes, and temperature changes.

Recommended Station Format

1. Group arrives at station
2. Review and discuss introduction questions:
 - What is DO?
 - Why is DO important?
 - What can happen if DO levels go too low?
 - What can cause DO to increase?
 - What can cause DO to decrease?
3. Test (See testing procedure)
4. Record results on student sheet
5. Compare collected data to the range of possible data on the diagram under "How does my data fit in?"
6. Students answer first question (How does my data compare with the range of possible data?)
7. Review and discuss answers
8. Students answer remainder of questions
9. Review and discuss answers
10. Move to next station

Dissolved Oxygen (DO)

Dissolved oxygen describes the amount of oxygen molecules that are held by the water. Oxygen gas becomes dissolved in water by: diffusing from the surrounding air, mixing and aerating through the movement of the water, and/or through release from photosynthesizing plants. Typically, the warmer and cloudier the water is, the less oxygen it can hold.

Do dissolved oxygen levels remain consistent in one water body over the course of a day?

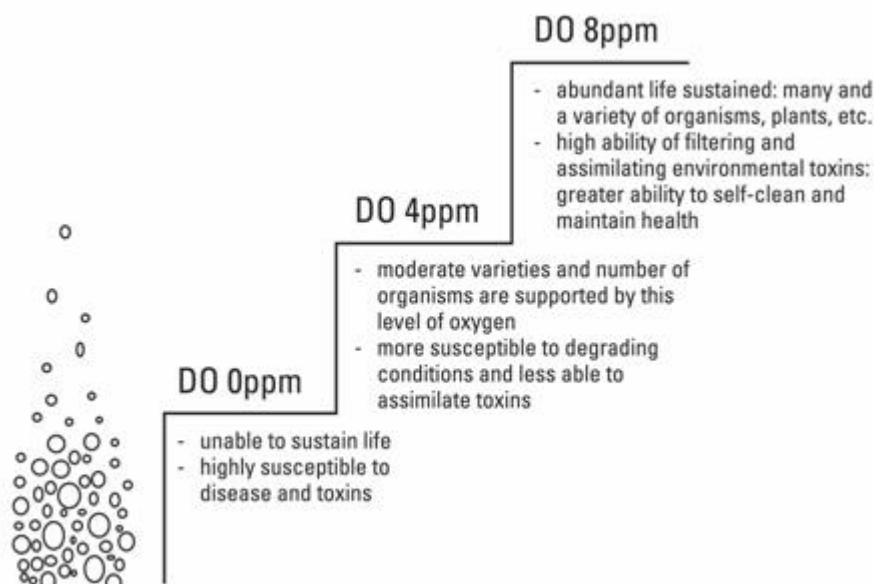
Dissolved oxygen levels can fluctuate throughout the day as the temperature and/or photosynthetic rate of plants and algae fluctuate. It can also change significantly from day to night and between seasons.

Most water bodies should have lots of oxygen during AWQA day sampling because of:

- ✍ the recent disappearance of ice cover (allowing more mixing with the available oxygen)
- ✍ increased runoff (i.e. higher flows) for flowing water bodies
- ✍ new plant growth (releasing oxygen) and less breakdown (which uses oxygen) of dead aquatic plants and algae at this time of the year

How do my data fit in?

Dissolved oxygen is important to the health of aquatic ecosystems and is an important measure of water quality. All aquatic animals need oxygen to survive. Natural waters with consistently high dissolved oxygen levels are usually healthy and stable environments, able to support a wide variety of plants and animals. Adequate concentrations of dissolved oxygen are necessary to support fish and other aquatic organisms. Oxygen also helps break down dead plant and animal matter (decomposition) within a lake, river, stream, or reservoir. If decomposition happens without oxygen, gases with offensive odours are produced—you get a stinky lake! Low oxygen concentrations can be damaging to the critical and developmental life stages of aquatic animals. This includes larval invertebrates and fish eggs. Although different types of plants and animals will vary in their ability to survive at low dissolved oxygen levels, the greater the DO in the waterbody, the more life it can support.



How did your DO results compare to the range of possible DO results? Does your water body exhibit the features identified in the graphic above?

For Discussion: Did the results reflect high, low, or moderate DO? Are there any other indicators of the level of DO? Think back to the Intro Worksheet and the Pre-Lab Information; is there a correlation with other water quality characteristics? What level of aquatic plant growth is there? Is life abundant? What types of aquatic organisms (e.g. plants and animals) do you find at your site?

Identify and explain why DO could decrease at your sample site:

For Discussion: Thinking about your answers to the question above, what things affect DO? Which of those things would specifically lead to a decrease in DO? For example: low plant life/decreased photosynthesis, low flow rate, low wind, decreased mixing, high temperature, high turbidity. What else?

Teacher's Guide Field Lab Test #2: pH

Teacher Information and Answer Key

Preparation

Read through the lab before you begin.

Materials

- ✍ large (10ml) test tube
- ✍ one pH reagent tablet
- ✍ rubber gloves and goggles
- ✍ colour coding chart

Ensure all sampling equipment is clean and free of contaminants (dust, skin oil, etc.) and dry. If you are sampling more than one site, rinse equipment repeatedly at the next site before testing.

Do not touch the inside or opening of any sampling containers or tubes to avoid contamination.

Testing Procedure

1. Rinse the tube three times in the waterbody
2. For flowing-water sites (rivers, streams, etc.)
 - ✍ aim the open end of your sampling tube upstream
 - ✍ place at mid-depth and allow the tube to overflow for about 30 seconds under water

For still-water sites (lakes, ponds, etc.)

 - ✍ submerge the sampling tube (open-side up) into the water, between 25 and 50 cm below the water surface

Try to avoid disturbing bottom sediments.
3. Gently pour water from the tube until the water level is at the 10ml mark
4. Drop in one pH tablet
5. Screw the cap on tightly
6. Invert repeatedly (**do not shake**) until the tablet has dissolved completely (approximately 1 minute)

Recommended Station Format

1. Group arrives at station
2. Review and discuss introduction questions:
 - What is pH?
 - Why is pH important?
 - What can happen if pH levels are low?
 - What can cause pH to change?
3. Test (See testing procedure)
4. Record results on student sheet
5. Compare collected data to the range of possible data on the diagram under "How does my data fit in?"
6. Students answer first question (How does my data compare with the range of possible data?)
7. Review and discuss answers
8. Students answer remainder of questions
9. Review and discuss answers
10. Move to next station

pH

pH is a measure of the acidity of water and is measured on a scale from 0 (most acidic) to 14 (most basic).

Surface water bodies with a pH ranging from 6 to 9 provide suitable habitat for most types of aquatic organisms. pH higher or lower than the normal range can result in a decrease in aquatic species. Factors that influence pH include: geology, human disturbances (e.g., wastewater, fertilizer run-off etc.) and acid rain.

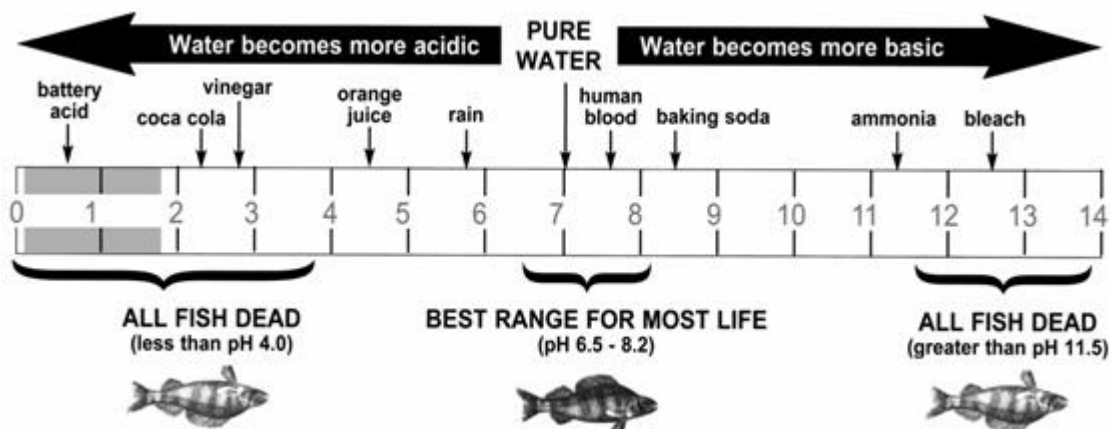
What is the normal pH range for Alberta's waterbodies?

The normal range of pH in Alberta waterbodies is between 6.5 and 9.5. The rocks and minerals in an area (geology) strongly influence the natural pH of water. Over time, the bedrock and soil in a given area will weather. Rainwater transports minerals to the rivers, streams, and lakes. Most waterbodies in Alberta are located in areas that have soils that were deposited long ago by glaciers. These waterbodies tend to be alkaline (pH of between 7 and 10). In contrast, waterbodies in the far northeast area of the province tend to have a pH slightly below 7. This area is part of the Canadian Shield and has a different geology.

How do my data fit in?

Most aquatic plants and animals can only survive within a certain pH range. Generally, the closer the pH is to neutral, the greater the number and variety of organisms that can survive. Water with a pH of 6 to 9 is suitable for most aquatic organisms. If pH moves higher or lower, the number of individuals and the number of species will decline.

Water quality is greatly affected by pH. One of the biggest concerns around pH levels in surface waters is the toxicity of metal elements. Metal elements are flushed into our water systems from surrounding land use through wastewater, and from other sources. With decreasing pH, metals become more readily absorbed by aquatic organisms. In the dissolved form, metals become toxic and can cause extreme physiological damage to aquatic life. Therefore, most plants and animals tend to be very sensitive to pH and cannot survive at a pH below 5.7. Few organisms can survive below a pH of 4. Fortunately, only a few examples of acidic lakes (pH less than 6.0) exist in Alberta. High pH levels can also be toxic and most aquatic organisms are intolerant of environments with a pH greater than 9.



How did your pH results compare to the range of possible pH results? What other materials have a similar pH to your sample? How would fish react to this pH?

For example, do your results indicate an acidic, basic, or neutral pH for your water body? In the diagram above, what things would have a similar pH to your sample (e.g., vinegar, cola, ammonia, pure water)? Given your results, do you think the fish in the water body you tested should be healthy, are struggling to survive, or are likely all dead? Are your results within the range that supports the widest variety of organisms (between pH 6 and 9)?

What may be influencing the pH of the waterbody you are testing?

Just as we read above, the pH of a water body has a lot to do with the location of the water body. For example, the rock (geological formation) in the area and the surrounding land use (e.g., runoff containing fertilizer).

Teacher's Guide Field Lab Test #3: Temperature

Teacher Information and Answer Key

Testing Procedure

1. Place the thermometer well below the surface of the water (i.e. up to the sampler's elbow). It is easiest to have both thermometers attached to the test kit container so that you get a reading throughout the entire range
2. Hold for one minute
3. If visible, record the temperature while the thermometer is submerged. If not, remove the thermometer from the water and record the temperature immediately

Special Considerations

Temperature measurements will vary at different depths within the water body. Taking measurements at a depth consistent with other sites tested or other types of tests taken at one site increases the integrity of the data. Your temperature measurement may be more representative of local conditions by taking a few measurements at different depths (e.g. at surface, at wrist-depth, at elbow-depth, and upper arm-depth) and averaging the results.

Preparation

Read through the lab before you begin.

Materials

- ✍ thermometer strips (1 cold temperature and 1 warm temperature)

The thermometers supplied with the test kit are adhesive, but small (and easy to lose in the water). For easy temperature testing, attach thermometers to the outside of the AWQA Day container and submerge the entire container in the water. It is best to attach the thermometers at least a day in advance to allow the adhesive to set.

Recommended Station Format

1. Group arrives at station
2. Review and discuss introduction questions:
 - Why is temperature important?
 - What can happen if temperature changes suddenly?
 - What can cause temperature to change?
3. Test (See testing procedure)
4. Record results on student sheet
5. Compare collected data to the range of possible data on the diagram under "How does my data fit in?"
6. Students answer first question (How does my data compare with the range of possible data?)
7. Review and discuss answers
8. Students answer remainder of questions
9. Review and discuss answers
10. Move to next station

Temperature

For AWQA Day, temperature is measured in degrees Celsius ($^{\circ}\text{C}$), on either a cold (below 14°C) or a warm (above 14°C) thermometer strip. Many factors can affect the temperature of a water body. Turbidity or shade can reduce the amount of sunlight that can warm the water. So can the volume or depth of the water. Human additions such as run-off, storm water or wastewater can affect the temperature as well. Seasonal changes such as air temperature and ice build-up can also cause the temperature to change.

What is the normal temperature range for Alberta's waterbodies?

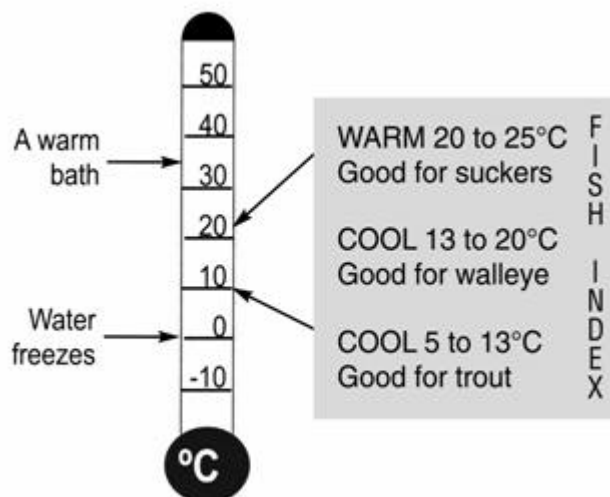
Temperature will vary greatly depending on the time of year, time of day, weather conditions, the size of lake, and the flow rate of the stream or river. In addition to seasonal changes, water temperatures in streams and lakes usually follow a daily pattern with warmer temperatures during the day and cooler temperatures at night.

How do my data fit in?

Temperature is important to water quality. Temperature affects the amount of dissolved oxygen in the water, the rate of photosynthesis by aquatic plants, and the sensitivity of organisms to toxic waste, parasites, and disease.

Water temperature is a key variable responsible for shaping the ecology of aquatic habitats. Temperature can both directly and indirectly impact aquatic plants and animals. Temperature indirectly affects animals by controlling dissolved oxygen concentrations (water can hold less dissolved oxygen when water temperature increases). Temperature directly affects the activity, metabolism, growth, and reproduction of plants and animals. The activity, growth, and reproduction of plants and animals increase as lakes and streams become warmer.

What happens when temperatures drop? If the water temperature is too low, the processes in plant and animal's bodies slow. Their activity slows and growth and reproduction cease. What happens when temperatures are high? The effect is similar to really low temperatures. When organisms experience environmental temperatures above their normal range, they use more energy for activities such as respiration and digestion. Then, less energy is available for growth and reproduction.



How did your temperature results compare to the range of possible temperature results? What type of fish would the water be appropriate for?

For example, according to the diagram above, would the water in your sample be considered cool or warm? Would your water body be best suited for one of the example types of fish (i.e., trout, walleye, or suckers)?

Identify one factor affecting the temperature of the location you are sampling.

Think back to the pre-lab information, is there a correlation with other water quality characteristics? Is turbidity (test #4) or shade a factor in the ability of the sun to warm the water? Is the water moving (fast or slow)?

It's June, early summer, and the water should be warming, but ice break up, winter thaw, and spring runoff are affecting the temperature. What about the weather? Is it cold and cloudy or warm and sunny?

Turbidity, shade, weather, season, and time of day are factors that could affect temperature.

What happens to plants and animals when water temperatures are very low?

If the water temperature is too low, the processes in animals and plants slow. Their activity slows, and growth and reproduction cease.

Teacher's Guide Field Lab Test #4: Turbidity

Teacher Information and Answer Key

Preparation

Read through the lab before you begin.

Materials

- ✍ white AWQA Day container
- ✍ Secchi disk icon sticker
- ✍ image-coding chart

Stick the Secchi disk icon sticker (circle with black and white sections) to the inside, bottom of the container. It is best to do this at least a day in advance to allow the adhesive to set.

Testing Procedure

1. Rinse the container three times in the water body
2. Flowing-water sites (rivers, streams, etc.)
 - ✍ aim the open end of your container upstream
 - ✍ place at mid-depth and allow the container to overflow for about 30 seconds under water

For still-water sites (lakes, ponds, etc.)

 - ✍ submerge the container (open-side up) into the water, between 25 and 50 cm below the water surface

Try to avoid disturbing bottom sediments. If you are standing in the water, move carefully. This will avoid disturbing soil and other materials on the bottom, which may affect your results
3. Gently pour water from the container until the water level is at the "fill line" marked on the outside of the container
4. With the lid off, place the image-coding chart on top of the open container so that you can see both the actual sticker (through the water) and the images on the chart at the same time
5. Look straight down into the container and choose the image that best reflects the appearance of the actual sticker

Special Considerations

Readings are easiest if taken in open, but slightly shaded conditions. Excessive light or shade will make discerning the image much more difficult and will affect your results.

Recommended Station Format

1. Group arrives at station
2. Review and discuss introduction questions:
 - What is turbidity?
 - What causes turbidity?
 - What can happen if turbidity is high?
3. Test (See testing procedure)
4. Record results on student sheet
5. Compare collected data to the range of possible data on the diagram under "How does my data fit in?"
6. Students answer first question (How does my data compare with the range of possible data?)
7. Discuss/ review answers
8. Students answer remainder of questions
9. Review and discuss answers
10. Move to next station

Turbidity

Turbidity is a measure of how clear the water is. Turbid water is caused by materials such as mud, silt, and algae floating or suspended in the water. Turbid water may be the result of soil erosion, urban runoff, algae growth, and bottom sediment disturbances due to boat traffic and abundant bottom feeding fish.

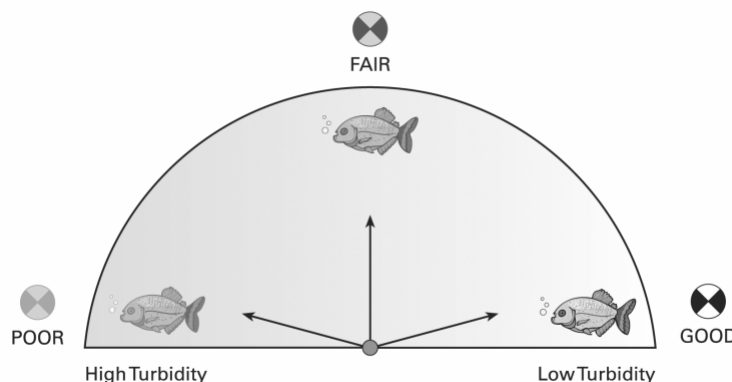
What is the normal turbidity range for Alberta's waterbodies?

The turbidity of Alberta rivers and lakes has a wide range depending on local conditions. All three levels of turbidity, indicated in the test kit, can be found in Alberta.

How do my data fit in?

Testing of turbidity is important, especially over time, to give us a sense of what effects the activities near and within the watershed are having on the amount of sediment deposits.

High turbidity levels can be natural to a waterbody because of the increased mixing of sediment, or increased plant productivity in that particular location. High levels of turbidity can also be symptoms of outside additions to the waterbody. For example, increased nutrient levels from fertilizers contained in run-off could lead to an unusually high level of plant/algal growth.



There are a number of concerns with high turbidity levels in our surface waters. High turbidity can have negative impacts on public health and can lead to concerns about drinking water. High turbidity can mean that there are increased amounts of disease-carrying bacteria that enter water through runoff and effluent. Excessive turbidity can also interfere with the water treatment process. As the amount of material suspended in water increases, water treatment processes such as filtering and chlorination may need to be increased. This makes proper treatment of drinking water both more intensive and more expensive. Further, turbid or murky lakes are considered by most to have poor water quality. Recreation activities may be limited or unsafe due to a high degree of turbidity due to excessive runoff or severe algal blooms. Rivers, streams, reservoirs and lakes that are clear are more attractive for recreation. For example, fewer people choose to swim in a lake during an algal bloom.



How did your turbidity results compare to the range of possible turbidity results?

According to the diagram above, would you consider the turbidity level in your sample to be poor, fair, or good?

If your water sample is turbid, what material is causing the high turbidity? If your sample is not turbid, what is not present in your sample?

Is vegetation adding to the turbidity of your sample (e.g., aquatic plants and algae)? Is it sediment that has been stirred up from the bottom due to excess movement? Is there sand or silt in your sample? What other things do you see adding to the turbidity of your sample?

What human activities could increase the turbidity of the waterbody you are testing?

See the pre-lab section for some examples of the effects of human activities such as urban runoff, increased nutrient levels from fertilizer use, boat traffic, and activities that lead to soil erosion.

Student Field Lab Test# 1

Dissolved Oxygen

Group Members: _____

Date:

Procedure

1. Rinse the tube three times in the water body
2. Flowing-water sites (rivers, streams, etc.):
 - ✍ aim the open end of your sampling tube upstream
 - ✍ place at mid-depth and allow the tube to fill, maintain it for about 30 seconds under water

For still-water sites (lakes, ponds, etc.):

- ✍ submerge the sampling tube (open-side up) into the water, between 25 and 50 cm below the water surface

Try to avoid excessive turbulence or bubbling.

3. Make sure your tube is full to the top.
4. Drop in two tablets (some water should spill over).
5. Screw the cap on tightly and more water should overflow.
6. Invert over and over (**do not shake**) until tablets have dissolved completely (approximately 4 minutes).

It will take approximately 5 minutes for the colour change to occur.

Preparation

Read through the lab before you begin.

Materials

- ✍ the small test tube (2ml)
- ✍ two dissolved oxygen reagent tablets
- ✍ rubber gloves and goggles
- ✍ colour coding chart

Ensure all sampling equipment is clean and free of contaminants (e.g. dust, skin oil, etc) and dry (if you are sampling more than one site just rinse repeatedly at the next site).

Do not touch the inside or opening of any sampling containers or tubes to help avoid contamination.

Special Considerations

Dissolved oxygen readings of your sample can easily be contaminated by excess shaking of the tube (or turbulence in the water when initially collecting), air bubbles or air space within the tube, intense sunlight, pressure changes and temperature changes.

Record your results below:

Match the colour of the sample with the dissolved oxygen colour chart in the test kit and record value as ppm.

ppm (parts per million)



How did your DO results compare to the range of possible DO results? Does your water body exhibits the features identified in the DO graphic on the following page?

Identify and explain why DO could decrease at your sample site:

Student Information Sheet

Dissolved Oxygen

Dissolved Oxygen (DO)

Dissolved oxygen describes the amount of oxygen molecules that are held by water and available to aquatic plants and animals.

What is the normal dissolved oxygen range for Alberta's water bodies?

Dissolved oxygen levels are affected by water temperature, aquatic plants, and water turbulence. DO can change significantly from day to night and season-to-season. Healthy water bodies generally have high concentrations of DO (greater than 6 ppm).

Temperature: Cold water can hold more oxygen than warm water

Aquatic plants and algae: Photosynthesizing plants add DO to the water, while rotting vegetation removed DO from the water

Water turbulence and wave action: The movement of water increases water contact with the atmosphere, resulting in an increase in DO levels

Most water bodies should have lots of oxygen during AWQA day sampling due to:

- ✍ the recent disappearance of ice cover
- ✍ mixing of whole standing water bodies from top to bottom
- ✍ increased runoff (i.e. higher flows) for flowing water bodies
- ✍ lack of decomposing aquatic plants, algae and cyano-bacteria, occur at this time of the year

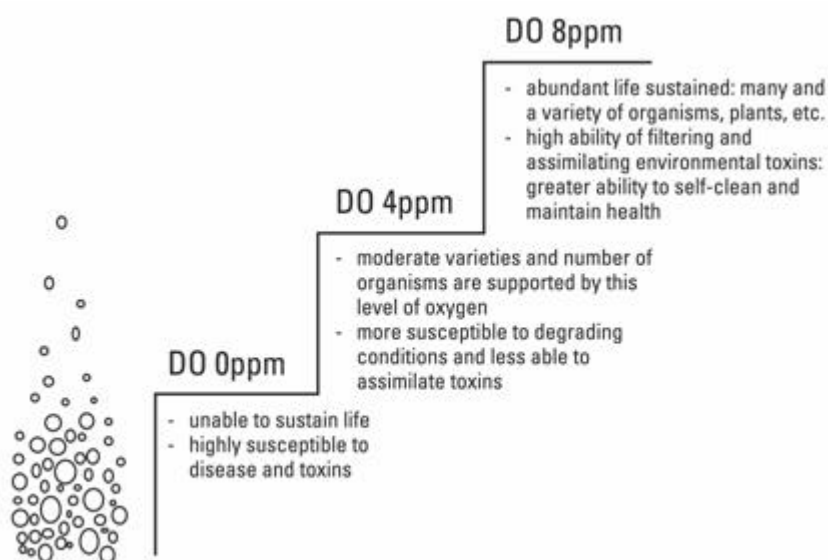
How do my data fit in?

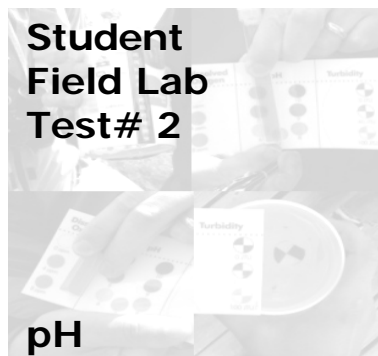
Dissolved oxygen is important to the health of aquatic ecosystems, and is an important measure of water quality. All aquatic animals need oxygen to survive. Water bodies with consistently high dissolved oxygen levels are usually healthy, stable environments that support a wide variety of plants and animals. In addition, high levels of dissolved oxygen prevent the production of offensive odors.

Oxygen is also necessary for microbial decomposition of dead plant and animal matter within a lake, river stream, or reservoir. Without oxygen, "anaerobic" bacteria (bacteria capable of living without oxygen) will take over decomposing dead matter. Anaerobic bacteria generate odorous byproducts including methane and hydrogen sulfide gases.

Low oxygen concentrations can be damaging to the critical life stages of some aquatic animals including larval invertebrates, and fish eggs and fry.

Like temperature, organisms differ in their tolerance to low dissolved oxygen levels.





Group Members: _____

Date:

Procedure

1. Rinse the tube three times in the water body.
2. Flowing-water sites (rivers, streams, etc.)
 - ✍ aim the open end of your sampling tube upstream
 - ✍ place at mid-depth and allow the tube to fill, maintain it for about 30 seconds under water
- For still-water sites (lakes, ponds, etc.)
 - ✍ submerge the sampling tube (open-side up) into the water, between 25 and 50 cm below the water surface

Try to avoid disturbing bottom sediments.
3. Gently pour water from the tube until the water level is at the 10ml mark.
4. Drop in one pH tablet.
5. Screw the cap on tightly.
6. Invert over and over (do not shake) until the tablet has dissolved completely (approximately 1 minute).

Preparation

Read through the lab before you begin.

Materials

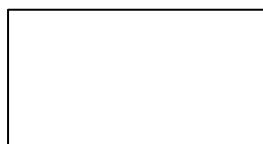
- ✍ the large (10ml) test tube
- ✍ one pH reagent tablet
- ✍ rubber gloves and goggles
- ✍ colour coding chart

Ensure all sampling equipment is clean and free of contaminants (e.g. dust, skin oil, etc) and dry (if you are sampling more than one site just rinse repeatedly at the next site).

Do not touch the inside or opening of any sampling containers or tubes to help avoid contamination.

Record your results below:

Match the colour of the sample with the pH colour chart in the test kit and record value.



pH



How did your pH results compare to the range of possible pH results? What other materials have a similar pH to your sample? How would fish react to this pH?

What may be influencing the pH of the water body you are testing?

Student Information Sheet

pH

pH

A measure of the acidity of water and is measured on a scale from 0 (most acidic) to 14 (most basic).

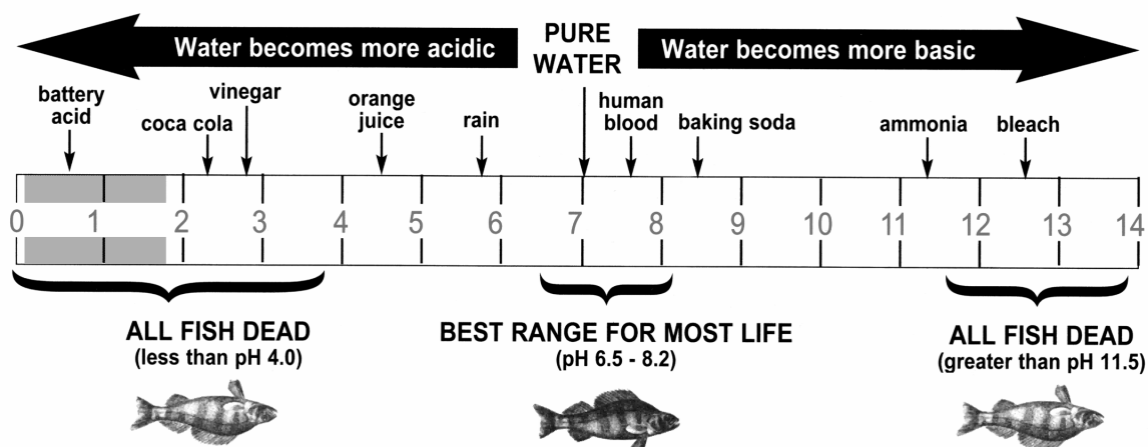
What is the normal pH range for Alberta's water bodies?

The normal range of pH in Alberta water bodies is between 6.5 and 9.5. The rocks and minerals in an area (geology) strongly influence the natural pH of water. Over time, the bedrock and soil in a given area will weather. Rainwater transports minerals to the rivers, streams, and lakes. Most water bodies in Alberta are located in areas that have soils that were deposited long ago by glaciers. These water bodies tend to be alkaline (pH of between 7 and 10). In contrast, water bodies in the far northeast area of the province tend to have a pH slightly below 7. This area is part of the Canadian Shield and has a different geology.

How do my data fit in?

Most aquatic plants and animals can only survive within a certain pH range. Generally, the closer the pH is to neutral, the greater the number and variety of organisms that can survive. Water with a pH of 6 to 9 is suitable for most aquatic organisms. If pH moves higher or lower, the number of individuals and the number of species will decline.

Water quality is greatly affected by pH. One of the biggest concerns around pH levels in surface waters is the toxicity of metal elements. Metal elements are flushed into our water systems from surrounding land use through wastewater, and from other sources. With decreasing pH, metals become more readily absorbed by aquatic organisms. In the dissolved form, metals become toxic and can cause extreme physiological damage to aquatic life. Therefore, most plants and animals tend to be very sensitive to pH and cannot survive at a pH below 5.7. Few organisms can survive below a pH of 4. Fortunately, only a few examples of acidic lakes (pH less than 6.0) exist in Alberta. High pH levels can also be toxic and most aquatic organisms are intolerant of environments with a pH greater than 9.



Student Field Lab Test# 3

Temperature

Group Members: _____

Date: _____

Preparation

Read through the lab before you begin.

Materials

- ✂ thermometer strips (1 cold temperature and 1 warm temperature)

The thermometers supplied with the test kit are adhesive; but small and easy to lose in the water. For easy temperature testing, attach thermometers to the outside of the AWQA Day container and submerge the entire container in the water. It is best to attach the thermometers at least a day in advance to allow the adhesive to set.

Procedure

1. Place the thermometer well below the surface of the water (i.e. up to the sampler's elbow).
2. Hold for one minute.
3. If visible, record the temperature while the thermometer is submerged. If not, remove the thermometer from the water and record the temperature immediately.

Special Considerations

Temperature measurements will vary at different depths within the water body. Taking measurements at a depth consistent with other sites tested or other types of tests taken at one site increases the integrity of the data. Your temperature measurement may be more representative of local conditions by taking a few measurements at different depths (e.g. at surface, at wrist-depth, at elbow-depth, and upper arm-depth) and averaging the results.

Record your results below:

Record as °C.

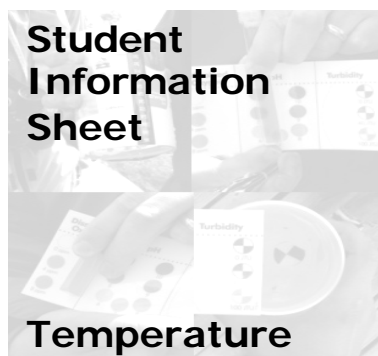
°C



How did your temperature results compare to the range of possible temperature results?

Identify one factor affecting the temperature of the location you are sampling:

What happens to plants and animals when water temperatures are very low?



Temperature

For AWQA Day, temperature is measured in degrees Celsius ($^{\circ}\text{C}$), on either a cold (below 14°C) or a warm (above 14°C) thermometer strip. Many factors can affect the temperature of a water body. Turbidity or shade can reduce the amount of sunlight that can warm the water. So can the volume or depth of the water. Human additions such as run-off, storm water, or wastewater can affect the temperature as well. Seasonal changes such as air temperature and ice build-up can also cause the temperature to change.

What is the normal temperature range for Alberta's water bodies?

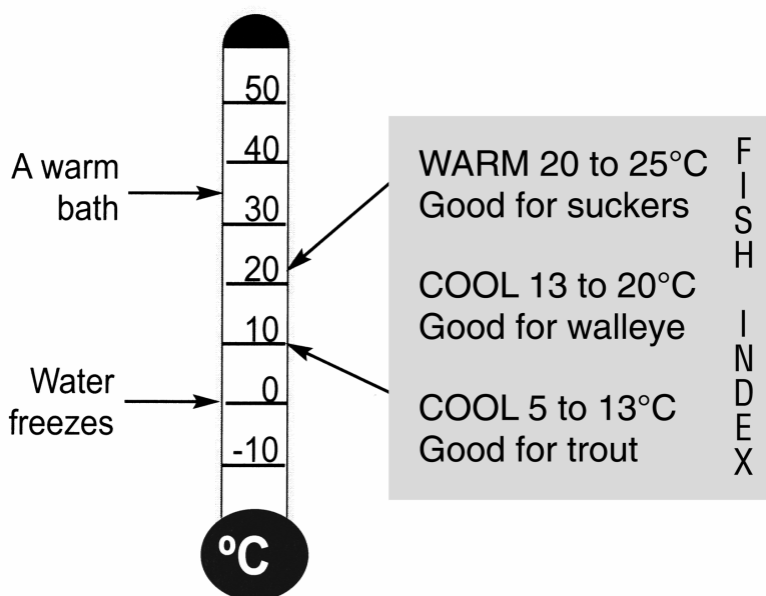
Temperature will vary greatly depending on the time of year, time of day, weather conditions, the size of lake, and the flow rate of the stream or river. In addition to seasonal changes, water temperatures in streams and lakes usually follow a daily pattern with warmer temperatures during the day and cooler temperatures at night.

How do my data fit in?

Temperature is important to water quality. Temperature affects the amount of dissolved oxygen in the water, the rate of photosynthesis by aquatic plants, and the sensitivity of organisms to toxic waste, parasites, and disease.

Water temperature is a key variable responsible for shaping the ecology of aquatic habitats. Temperature can both directly and indirectly impact aquatic plants and animals. Temperature indirectly affects animals by controlling dissolved oxygen concentrations (water can hold less dissolved oxygen when water temperature increases). Temperature directly affects the activity, metabolism, growth and reproduction of plants and animals. As lakes and streams become warmer, the activity, growth and reproduction of the plants and animals that live there increase, and the water becomes teeming with life.

What happens when temperatures drop? If the water temperature is too low, the processes in plant and animal's bodies slow. Their activity slows and growth and reproduction cease. What happens when temperatures are high? The effect is similar to really low temperatures. When organisms experience environmental temperatures above their normal range, they use more energy for activities such as respiration and digestion. Then, less energy is available for growth and reproduction.



Student Field Lab Test# 4

Turbidity

Group Members: _____

Date: _____

Procedure

1. Rinse the container three times in the water body.
2. Flowing-water sites (rivers, streams, etc.)
 - ✍ aim the open end of your container upstream
 - ✍ place at mid-depth and allow the container to fill, maintain it for about 30 seconds under water

For still-water sites (lakes, ponds, etc.)

- ✍ submerge the container (open-side up) into the water, between 25 and 50 cm below the water surface

Try to avoid disturbing bottom sediments.

3. Gently pour water from the container until the water level is at the "fill line" marked on the outside of the container.
4. With the lid off, place the image-coding chart on top of the open container so that you can see both the actual sticker (through the water) and the images on the chart at the same time.
5. Look straight down into the container and choose the image that best reflects the appearance of the actual sticker.

Preparation

Read through the lab before you begin.

Materials

- ✍ the white AWQA Day container
- ✍ Secchi disk icon sticker
- ✍ image-coding chart

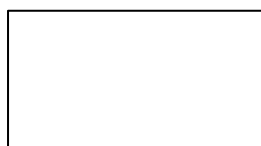
Stick the Secchi disk icon sticker (circle with black and white sections) to the inside, bottom of the container. It is best to do this at least a day in advance to allow the adhesive to set.

Special Considerations

Readings are easiest if taken in open, but slightly shaded conditions. Excessive light or shade will make discerning the image much more difficult and will affect your results.

Record your results below:

Choose the diagram that most closely matches the appearance of the Secchi Disk icon as you see it through the water sample and record as JTU.



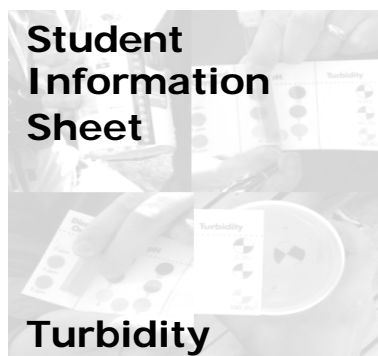
JTU (Jackson Turbidity Unit)



How did your turbidity results compare to the range of possible turbidity results?

If your water sample is turbid, what material is causing the high turbidity? If your sample is not turbid, what is not present in your sample?

What human activities could increase the turbidity of the water body you are testing?



Turbidity

Turbidity is a measure of how clear the water is. Turbid water is caused by materials such as mud, silt, and algae floating or suspended in the water. Turbid water may be the result of soil erosion, urban runoff, algae growth, and bottom sediment disturbances due to boat traffic and abundant bottom feeding fish.

What is the normal turbidity range for Alberta's waterbodies?

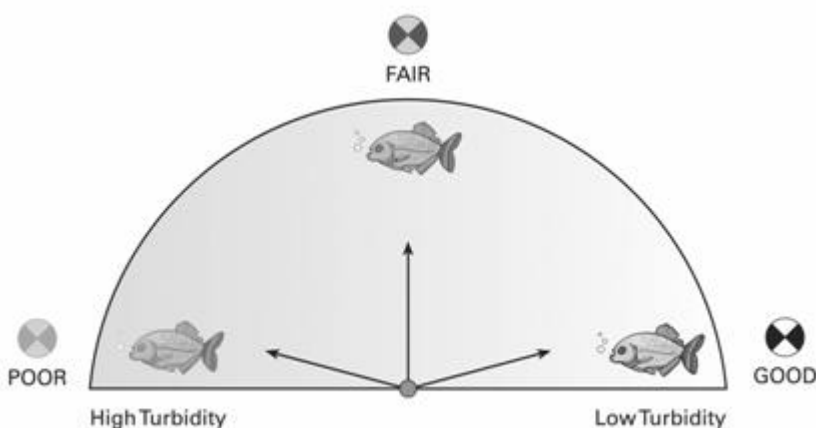
The turbidity of Alberta rivers and lakes has a wide range depending on local conditions. All three levels of turbidity, indicated in the test kit, can be found in Alberta.

How do my data fit in?

Testing of turbidity is important, especially over time, to give us a sense of what effects the activities near and within the watershed are having on the amount of sediment deposits.

High turbidity levels can be natural to a waterbody because of the increased mixing of sediment, or increased plant productivity in that particular location. High levels of turbidity can also be symptoms of outside additions to the waterbody. For example, increased nutrient levels from fertilizers contained in run-off could lead to an unusually high level of plant/algal growth.

There are a number of concerns with high turbidity levels in our surface waters including negative impacts on public health and drinking water. High turbidity can indicate increased amounts of disease-carrying bacteria that enter water through runoff and effluent. Excessive turbidity can also interfere with the water treatment process. As the amount of material suspended in water increases, water treatment processes such as filtering and chlorination may need to be increased. This makes proper treatment of drinking water both more intensive and more expensive. Further, turbid or murky lakes are considered by most to have poor water quality. Recreation activities may be limited or unsafe due to a high degree of turbidity due to excessive runoff or severe algal blooms. Rivers, streams, reservoirs and lakes that are clear are more attractive for recreation. Fewer people choose to swim in a lake during an algal bloom.



Teacher's Guide Classroom Post-Lab

Reviewing Results Teacher Information

Water Quality Monitoring—Reviewing Results

- ✍ If time was limited during the field lab, review the information and questions on the backside of each lab.
- ✍ Compile the data and discuss what the results really mean. Allow class time to go over results and discuss how your testing fits into the “Bigger Picture”.

Human Activities

- ✍ Review with students how human activities can affect, or cause changes in water quality. Explore the possible impacts on aquatic habitats, downstream users, etc.

Optional Extension Activities

Hold a mock town-hall meeting:

Provide a fun and interactive way to discuss the potential impacts on the quality of your local watershed. Have the students break into groups, each representing part of the local community (e.g. shop owners, residential home owners, farmers/ranchers, recreationalists, town council, golf course operators, etc.). Using the information contained on the AWQA Day Lab Activity Sheets, debate water quality issues within your community. You may want to discuss possible implications of the results obtained from your testing (e.g. What do the data you collected mean? How does this translate to potential water quality concerns in your community?). You could also discuss other, or future, potential impacts that may need to be considered (e.g. new developments, littering, increased population, increased waste and wastewater, etc.). You could include the following suggestion of creating a Water Management Plan as the final summary report of the town hall meeting members.

Design a local Water Management Plan:

In groups (e.g., as the representative groups at a mock town hall meeting) or as individuals, have students draw up a Water Management Plan by answering the following questions:

- ✍ Identify your planning area (community/water body/watershed)
- ✍ Summarize your water quality test results
- ✍ What are the top three concerns for water health within your community? (e.g. increased nutrients contained in run-off and loss of riparian areas, both leading to high turbidity)
- ✍ What are the potential causes of those water quality issues (e.g. encroaching recreational or urban development)?
- ✍ List two ways you can address each issue, focusing on local government initiatives and encouraging citizen action

AWQA Day Snapshot Testing—Join the Big Picture

Snapshot monitoring: *when multiple sites throughout a geographic area are sampled within a short period of time.*

The AWQA Day program will develop a “snapshot” of water quality in time, capturing a picture of water body health across Alberta. Together we are creating a province-wide community of water stewards and raising awareness for water health.

Contribute to the provincial picture! Enter your results!

Make sure you and your class are captured in the AWQA Day database by entering your results on www.awqa.ca and joining hundreds of other water stewards across Alberta.

Teacher's Guide Post-Lab Classroom

Water Quality Extension Worksheet— Teacher Key

Emerging Issues

Household Sources of Organic Contaminants In Treated Wastewater

People are the main source of pharmaceuticals and related compounds to the environment.

What do you do?

Describe actions you and your family take to prevent household organic contaminants from entering our environment.

Check the emerging issues section on the previous page. To help prevent household organic contaminants from entering waterbodies, we must not flush pharmaceuticals and anti-bacterial soaps through our drains. Bring unused pharmaceuticals back to the pharmacy for proper disposal. Purchasing regular cleaning products that are not anti-bacterial to get the cleaning job done. Regular products interfere less with the balance of our environment.

Home Audit—Pesticide and Fertilizer, Products and Use

Take a look around your home and see what types of products you and your family use to look after your yard and garden, or even your indoor plants. Check under the sink, in the garage and garden shed...

What did you find?	How often is it used?	What is the product used for?	What should be done during application to reduce the chances of this product ending up in the water system?

What might be some alternative products or practices to replace the pesticides and fertilizers you found?

According to the facts on fertilizers contained in the lab, apply only what your plants need. Discover the natural nutrient levels of your soil and use native plants and other natural sources to adjust the nutrient levels. The information on pesticide use contained in this lab suggests using alternative forms of pest control that do not contain man-made chemicals or learning to manage pest problems through prevention. Most pesticides do not prevent pest problems, they only control pests once they are present.

Student Post-Lab Classroom

Water Quality Extension— Worksheet

Emerging Issues –

Household Sources of Organic Contaminants In Treated Wastewater

People are the main source of pharmaceuticals and related compounds to the environment.

What do you do?

Describe actions you and your family take to prevent household organic contaminants from entering our environment.

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Take a look around your home and see what types of products you and your family use to look after your yard and garden, or even your indoor plants. Check under the sink, in the garage and garden shed...

What did you find?	How often is it used?	What is the product used for?	What should be done during application to reduce the chances of this product ending up in the water system?

What might be some alternative products or practices to replace the pesticides and fertilizers you found?

Teacher's Guide

Registering for AWQA Day and Planning a Field Testing Activity

Register

Register your class on the website, www.awqa.ca. One teacher should register for each participating class. As the AWQA Day registrant you will receive a kit ID number. This kit ID is important for returning to the website and entering information about your results collected. Each registrant's profile allows him or her to enter multiple sites, and results for each of those sites.

Order your test kit

During the registration process you will need to indicate you want to receive an AWQA Day water quality test kit. On the AWQA Day Test Kit Order Form select a group kit for "1 1-30" people. Test kits will be mailed out to classes in May.

Choose

You may choose to test any surface water body that is of interest to you. This could be a lake, pond, wetland, river, stream, creek, irrigation canal, or reservoir. Choose a spot where access is convenient and safe, and


Appendix—AWQA Day Checklist

where property owner permission is granted (if applicable). Ensure there is plenty of room for setting up the testing/activity stations nearby.

Select

Select a day from May 15 to June 30 when you and your class are able to sample and test a local water body.

Arrange

Make sure any necessary arrangements are made for your water-testing day, such as transportation to the testing site, reserve areas/make plans for eating lunch or snacks (if necessary), equipment for testing stations, parent/teacher volunteers and class sets (photocopies) of lab activity sheets (double sided please ). See section on "Creating an Outdoor Lab" below

Once you have chosen the water body to sample, decide on the particular sampling location(s). You may sample at more than one location. Each AWQA Day test kit has enough supplies to test multiple sites. Sampling several locations on the same water body will build a better picture of the average characteristics of that water body. It will also allow you to contribute more information to the province-wide water quality snapshot.

Register your site(s)

Once you have chosen the water body to sample, decide on the particular sampling location(s). You may sample at more than one location. Each AWQA Day test kit has enough supplies to test multiple sites. Sampling several locations on the same water body will build a better picture of the average characteristics of that water body.

To register your sites, log onto your profile on the AWQA Day website (through the ENTER DATA top menu) and click on "Add a Site". You may wish to register multiple student results for each site by naming the sites by

Things to consider when choosing sampling sites:

- Water quality will vary within a waterbody depending on depth, distance from shore, etc. Since near-shore samples are less representative, you may want to consider collecting your sample from a bridge, at the end of a dock, or from a boat.
- The best source of comparative data comes from tests on different parts of a waterbody. (For example, above and below a point where run-off water runs into a river.)
- **Do not compromise safety in order to collect a representative sample!**
- It is important that you adequately describe your site so that you or others can find it again for future sampling. Your description of your monitoring location should consist of very specific directions, and other representative characteristics such as surrounding landmarks.
- A camera, to record visual images of the site and conditions of the sampling day, is a great tool for later comparison and data collection.

number (perhaps each number represents a student group). For example, “West Boat Launch 1, West Boat Launch 2, East Side of Dock 1, East Side of Dock 2, and so on.

Prepare

Pre-Lab Classroom Activity

1. *Introduce Water Quality parameters*

Resource Provided: Introduction to Water Quality Teacher Resource and Student worksheet

2. *Introduction to Water Quality Testing*

Briefly describe the process for the lab (i.e. groups, moving through stations, and a brief description of each AWQA Day sampling preparation/procedure).

Optional activities

Practice Sampling

Sample in the classroom to prepare for the big day: You could use the extra reagent tablets from the kits to practice testing with things like water from an aquarium, drinking water, mp water, snow melt, etc (make sure you have enough reagent tablets, pus extras for the field testing day.) Student will gain an understanding of the equipment and procedures for AWQA Day testing. You can introduce discussions on water quality by comparing results and what things seem to affect the four water quality parameters being tested. How might this differ from what you would expect for you field-testing day?

Research your sampling location:

Find a map showing the testing location and discuss possible surrounding land use. How might that land use/activity affect the water quality characteristics tested for AWQA Day? What might you expect to see? What might you expect not to see? How might that area have looked differently in the past? In the future?

Field-Lab Preparation

 **Break the class into four groups.** The group testing kit provides 4 complete testing kits.

 **Field test format.**


Option 1: Multiples testing sites in very close proximity – 4 stations (one for each parameter). Groups rotate through the stations and do a different test at each location. (Recommend Station Format is designed for this option though it can be easily adapted for option 2 or 3)


Option 2 Multiples testing sites in very close proximity – No stations to rotate through. The group works together with one test kit at one location and do all the tests at one location.

Option 3 Multiple testing sites not in close proximity – No stations to rotate through. The group works together at one location and completes all the tests in the kit. (This is a good option if you want to look at how test results can differ before and after an inflow, or if you want to test different water bodies (stream, lake, and river)

* Classroom Testing

If you are not able to travel to a water body for testing, you may choose to collect samples from a local water body and bring them into the class for testing.

 Make **copies of the student sheets** for students to use during field-testing. Remind students to bring a book or hard surface to write on.

 Make **copy of the Teacher Key for each parameter** for use during field-testing. This will ensure the adult leader will have a format outline for each station, answers for all of the questions on the student sheet and tips on setting up the testing stations. It is recommended these sheets are laminated or put in a plastic cover to allow reuse and prevent water damage.

Most groups should be able to complete each parameter in 15 – 20 minutes if the format above is followed with adults leading discussion and students required to record their answers to the questions.

Equipment/Supplies needed:

- ✍ AWQA Day Group Test Kits

Ensure each kit includes the following:

- ? One large (10 ml) test tube
- ? One small (2 ml) test tube
- ? Color coding chart
- ? pH reagent tablets
- ? Dissolved oxygen reagent tablets
- ? Secchi disk icon sticker

Additional Required Materials

- ✍ Two small pails for collecting used samples at the Dissolved Oxygen and pH stations. (For disposal, flush the pail contents down a drain with plenty of water).
- ✍ Rubber gloves and goggles for the Dissolved Oxygen and pH stations (enough for all participants).
- ✍ **Class set of (double-sided) copies of Student Lab Activities** numbers 1 through 4 (one set for each student or student group that will be responsible for recording results).
- ✍ One laminated or report-covered copy of each Teacher Key to stay at the appropriate station

Test

Field Testing Outline

Class Introduction:

- ✍ Review safety precautions and site layout, (e.g. where the appropriate collection sites are located, the location of each lab station where the testing will be done, etc.).
- ✍ Do a visual scan of the site, pointing out and discussing:
 - o potential safety hazards
 - o available facilities
 - o surrounding land uses or other activities with possible implications for the water quality of the water body
- ✍ Briefly describe the process for the lab (i.e. moving through stations, and a brief description of each AWQA Day sampling preparation/procedure).

Test:

- ✍ Follow directions on the Lab Activity Sheets and in water quality test kits.
- ✍ Have each group (or each student) fill out their lab activity sheets as they complete the stations. Follow-up can occur in the field, or back in the classroom.

Post

Compile the written results and post them on the online database (Go to www.awqa.ca, click on ENTER DATA and enter your results for each sampling location). Each Grade 8 & 9 class that posts their results on-line is has the opportunity to win one of four awards, valued at \$400 each to be used towards environment or science related program or supplies for your school.

Review Results

- ✍ Follow up in class using the resources provided: Teacher's Guide Post-Lab Reviewing results.

Teacher's Guide

Appendix— Introduction to Water Quality Testing

Water Quality Parameters

The four water quality parameters being tested for AWQA Day are **dissolved oxygen, pH, temperature** and **turbidity**.

These tests for water quality characteristics are relatively simple to conduct and serve as good preliminary signs of the effects surrounding land use and activities have on the aquatic system. If these parameters are observed over time and at regular intervals they can serve as early indicators that water quality is changing. A rigorous measure of water quality requires more intensive testing than AWQA Day provides. However, the water quality test kits will teach us about four general indicators of water health.

Dissolved Oxygen (DO)

Dissolved oxygen describes the amount of oxygen molecules that are held by the water. Oxygen gas becomes dissolved in water by: diffusing from the surrounding air, mixing and aerating through the movement of the water, and/or through release from photosynthesizing plants. In winter, ice cover restricts the amount of oxygen that can enter the water, and replenishment by photosynthesis is greatly reduced. In summer, dissolved oxygen levels may fluctuate dramatically from day to night. Typically, the warmer and cloudier the water is, the less oxygen it can hold.

Why is dissolved oxygen important to aquatic ecosystems?

Oxygen is extremely important to all living things. Aquatic organisms require various levels of dissolved oxygen to support their aerobic respiration (breathe oxygen). Waters with high concentrations of dissolved oxygen are generally considered to be healthy and capable of supporting a wide variety and number of organisms. When oxygen levels in a water body are too low, fish and other organisms can suffocate. Low oxygen levels can only be tolerated by a small number of species; many fish and other aquatic organisms suffocate and die without enough oxygen.

pH

pH is the measure of the intensity of the acid or base chemistry of the water.

pH is measured on a scale from 0 (the most acidic) to 14 (the most basic), and a pH of 7 is neutral. A pH level between 6 and 9 is usually considered suitable for most organisms. The number of different organisms that can survive outside this range is greatly reduced. A water body's pH is dependent on surrounding types of rock and soil chemistry. It can also be affected by run-off from human activities (wastewater, fertilizers, chemical spills, etc.), acid rain and biological activity such as the photosynthesis of aquatic plants, which can influence *daily* changes in a water body's pH.

Why is pH important to aquatic ecosystems?

The acidity or pH level of water influences biological and chemical processes. This impacts aquatic organisms, influencing their ability to uptake nutrients and increasing the toxicity of other substances that they may be exposed to. For example, when acidic waters (low pH values) come into contact with certain chemicals and metals, the chemicals or metals become more toxic to aquatic organisms than if they had not been in acidic waters.

Surface Water Quality in Alberta

- ✍ Many factors influence water quality in Alberta: seasonal changes, extreme weather, wildlife activity, soil characteristics, and others.
- ✍ Human activities can affect water quality impacting the survival of aquatic life within the water body, use of water by other users, and increase the cost and intensity of drinking water treatment.

When monitoring water quality, professionals test water samples under strict conditions and specialized and highly sensitive equipment. They can also monitor many more parameters than those included in the AWQA Day kit. But all types of water monitoring are important to highlight changes over time, discover the impact of activities around the water, and help us learn about how our water systems work.

Temperature

For AWQA Day, temperature is measured in degrees Celsius (°C), on either a cold (below 14°C) or a warm (above 14°C) thermometer strip. Water temperature is regulated mainly by the season, weather conditions, time of day, and for moving water, the flow rate. Many other factors can also affect the temperature of a water body. For example, turbidity in water increases the amount of heat absorbed from sunlight and shade can reduce the amount of sunlight that can warm the water.

Why is temperature important to aquatic ecosystems?

Temperature influences the rate of the biological and chemical processes, controlling function and productivity in plants and animals within the aquatic system. Most aquatic organisms have a limited range of tolerance to temperature changes. When sudden temperature changes do occur it will usually have a significant effect on the performance and survival of aquatic organisms.

Turbidity

Turbidity is a measure of how clear the water is. Turbid water is caused by materials such as mud, silt, and algae floating or suspended in the water. Turbid water may be the result of soil erosion, urban runoff, algae growth, and bottom sediment disturbances due to boat traffic and abundant bottom feeding fish.

Why is turbidity important to aquatic ecosystems?

High turbidity can decrease the suitability of a water body for aquatic life. The degree of turbidity may affect the amount of dissolved oxygen and the water temperature. As high turbidity may reduce light transmission, the rate of photosynthesis by aquatic plants could be reduced, therefore reducing the amount of dissolved oxygen. Increased sediment in the water helps to trap heat and can cause an increase in water temperature. Also, as turbidity rises animals that depend on their eyesight to forage ('visual predators') may be affected by reduced visibility.

More in-depth information on each of these parameters can be found at www.awqa.ca

Extension: Human Impacts on Water Quality

Human activities can influence the conditions in a water body and affect the ability of aquatic life to survive.

For example:

Thermal pollution

Industries that use water for cooling processes often return warmer water back into the system (for example, a river). This practice is regulated by government. The addition of warmer water back into a water body is referred to as thermal pollution. Thermal pollution results in increased water temperatures and causes a decrease in the amount of dissolved oxygen the water body can hold.

Urban and rural run-off and wastewater

Urban storm water, sewage discharge, and rural runoff may contain elevated amounts of organic material, nutrients from fertilizers and other chemical and biological materials. These additions to a water system can lead to various changes including increases in toxicity, turbidity, algal blooms, and chemical

Teacher's Guide Classroom Discussion Activity

Water Quality Extension—Teacher Information and Answer Key

Water Quality and Us

Climate, season, wildlife activity, and human activity are some of the many factors that impact the quality of surface waters in Alberta. The water we use is connected to all the water in our watersheds; and, our activities can impact water resources in our watersheds.

Fertilizer Use:

What are fertilizers?

Fertilizers are chemicals that contain the nutrients nitrogen and phosphorus, which are required for growth of land plants, like crops and lawns, as well as aquatic plants, like algae.

What is the issue?

Although nutrients are beneficial to both land and water plants, they can become water contaminants if present in excessive amounts. When too much nitrogen and phosphorus reach surface water they can cause massive amounts of algae to grow, called a bloom. When plants become too abundant, they can change the chemistry of the water. An algal bloom not only looks and smells bad but also pulls oxygen out of the water when it decomposes. Less oxygen in water makes it hard for fish

and other aquatic organisms to live—they get stressed! This also causes problems for boaters, swimmers, and filtration systems. Too much nitrogen in drinking water supplies can result in human and animal health problems.

How can my family make a difference?

Every Albertan who uses fertilizers can make a difference by remembering that even small applications of nutrients in yards and gardens can eventually find their way to shared water resources. Apply only what your plants need; discover the natural nutrient levels of your soil and use native plants and other natural sources to adjust the nutrient levels.

For more information visit:

Alberta Environment at www.environment.gov.ab.ca.

Alberta Agriculture, Food and Rural Development
www.agric.gov.ab.ca

Did you know?

- ✍ Many soils contain enough phosphorus to grow healthy lawns without any added fertilizer!
-
- ✍ Plants are needed along shorelines to prevent erosion, and filter out sediment, soil, fertilizers and pesticides. The band of native grasses, shrubs and trees surrounding water bodies is called a riparian area.
- ✍ About 11% of Alberta's riparian areas are healthy, 49% are healthy with problems and 40% are unhealthy. (source: Cows and Fish)
-
- ✍ Soil and sediment are also sources of nutrients that can cause water quality to decline. High **turbidity** (or low water clarity) of a stream or lake can occur because of an algal bloom, or because sediment gets carried in due to erosion or runoff. High turbidity is often an indication of poorer water quality.

Pesticide Use.

What are pesticides?

"Pesticides" is a broad term referring to man-made chemicals designed to control, inhibit or destroy what we consider pests. Pesticides include herbicides (plants), insecticides (insects), and fungicides (fungus).

What is the issue?

Pesticide use is complex and many scientists are working to answer all the unanswered questions. However, the bottom-line is: *pesticides are designed to be toxic*. Because of this, some have the potential to inadvertently kill or harm species other than those they target.

This means when pesticides are misapplied, added to our water systems through rain events and run-off, or otherwise gain entry to water bodies, they can have adverse effects on aquatic life. Low levels of pesticides are commonly found in surface waters throughout Alberta; usually several pesticides can be detected at any given time. The extent of the impacts of low levels of pesticides on aquatic systems is largely unknown, especially when several pesticides are involved. For this reason, continuous monitoring is important to better understand their impact on the environment.

How can my family make a difference?

Every Albertan who uses pesticides can make a difference by remembering that even small applications of chemicals in yards and gardens can eventually find their way to shared water resources. Use alternative forms of pest control that do not contain man-made chemicals or learn to manage pest problems through prevention, most pesticides do not prevent pest problems; they only control pests once they are present.

For more information visit:

Alberta Environment at www.environment.gov.ab.ca.

Health Canada's Pest Management Regulatory Agency at www.pmr-arla.gc.

Emerging Issues –

Household Sources of Organic Compounds in Treated Wastewater - Guidelines will be set as further information on the effects of these compounds, at different concentrations, is determined for water quality.

Certain household medications, and other substances we use in and around our homes are detected in surface water bodies and have potential impacts on water quality and aquatic ecosystem health.

What can we do?

? *Pharmaceuticals*

Don't flush your leftovers! Pharmaceuticals that are flushed down the toilet or thrown in the garbage can enter the water system. Take all unused, or "dead" drugs back to your local pharmacy for proper disposal. www.albertapharmacy.ca

? *Household Soaps*

Check around your home for soaps labeled "anti-bacterial". The anti-bacterial agents in these soaps do not provide "a better clean", and actually work against water treatment facilities and aquatic system health by killing off beneficial bacteria.

Student— Classroom Discussion Activity

Water Quality Extension

Water Quality and Us—How can my family's actions at home affect water quality?

Climate, season, wildlife activity, and human activity are some of the many factors that impact the quality of surface waters in Alberta. The water we use is connected to all the water in our watersheds; often our activities in our watersheds can impact our water resources.

Example: One thing we can think about around home is fertilizer use in our yards and gardens.

What are fertilizers?

Fertilizers are chemicals that contain the nutrients nitrogen and phosphorus, which are required for growth of land plants, like crops and lawns, as well as aquatic plants, like algae.

What is the issue?

Although nutrients are beneficial to both land and water plants, they can become water contaminants if present in excessive amounts. When too much nitrogen and phosphorus reach surface water they can cause massive amounts of algae to grow, called a bloom. When plants become too abundant, they can change the chemistry of the water. An algal bloom

not only looks and smells bad but also pulls oxygen out of the water when it decomposes. Less oxygen in water makes it hard for fish and other aquatic organisms to live – they get stressed! This also causes problems for boaters, swimmers, and filtration systems. Too much nitrogen in drinking water supplies can result in human and animal health problems.

How can my family make a difference?

Every Albertan who uses fertilizers can make a difference by remembering that even small applications of nutrients in yards and gardens can eventually find their way to shared water resources. Apply only what your plants need; discover the natural nutrient levels of your soil and use native plants and other natural sources to adjust the nutrient levels.

For more information visit:

Alberta Environment at
www.environment.gov.ab.ca

Alberta Agriculture, Food and Rural Development
www.agric.gov.ab.ca

Did you know?

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Another thing we can think about around our yards and gardens is pesticide use.

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